REMARKS

With entry of the foregoing amendments, claims 1-36 are pending in this application. In the previous office action, the Examiner rejected claims 1-36. Claims 1, 3, 8, 17, 19, 27, 32 and 34-36 have been amended. Claims 2 and 18 are now cancelled with the features of those claims being incorporated into claims 1 and 17 respectively. No new matter is introduced. Applicants respectfully request reconsideration of this application.

Introduction

In a multiplexed system, multiple users share access to physical layer resources, such as radio channels. There are always delays inherent in assignment and reassignment of the physical layer resource, which propagate up to the higher protocol layers. Such additional delays are not insignificant. For example, a Round Trip Transfer (RTT) delay may be on the order of one second in a typical TCP/IP network layer protocol, whereas physical layer resources may require 200 milliseconds or more to reassign. Thus, a time out mechanism which only accommodates the return layer delay will unnecessarily time out prematurely.

A system and method are disclosed for monitoring and controlling message delivery over a single point-to-point connection including a wireless link between a sending node and a receiving node. Specifically, the method, as implemented in a wireless gateway at either end of a wireless link, includes detecting when an incoming message is received, determining a timeout corresponding to the timing of the acknowledgment message, and sending a suppression message over the connection back to the sending node if the acknowledgment message has not been sent from the receiving node before the timeout expires.

The invention prevents activation of congestion control mechanisms which reduce throughput. By determining when a sender will timeout due to non-receipt of an ACK, and intervening with a suppression message to pause the sender, congestion control mechanisms such as slow start and congestion avoidance are prevented from activation. In this manner, the reduction in message throughput caused by congestion control mechanisms is avoided, thereby allowing the sender to resume message delivery at the same rate at which it was delivering messages when the suppression message was received.

Sending a suppression message, therefore, prevents the sender from timing out for failure to receive a timely ACK. Since the sliding window is not reset to the initial size, as would have occurred if a timeout occurred, the receiver can send a resume message when the ACK is received. The sender then resumes message transmission with the same window size that was in effect when the suppression message was received. Since a larger window potentially allows more packets to be sent at a time, message traffic throughput is increased.

The connection and associated parameters between the sender and receiver remain consistent throughout the pause periods. Since the connection remains a single end-to-end connection, no tearing down or setting up of connections and buffering messages received in the interim, is required. Further, no connection parameters at either the sender or receiver in the wired network need be modified to conform to differences in the wired and wireless communication links. In this manner, the users served by the wireless link are less burdened with the wired link congestion control mechanisms which can tend to have a negative result on throughput over a wireless link.

Claim Objections

Applicants thank the Examiner for identifying the typographical error in claim 27. Appropriate correction of this claim has been made. Withdrawal of this objection is respectfully requested.

Claim Rejections – 35 U.S.C. § 112

The Examiner rejected claim 1 under 35 U.S.C. § 112, second paragraph, as being indefinite. The Examiner is of the opinion that claim 1 is unclear as to whether or not an acknowledgement message is sent over the established connection to the remote node. Claim 1 is now amended to clarify that an acknowledgement message is expected over the connection from the receiving node and that a suppression message is sent over the connection to the sending node if that acknowledgement message has not been sent.

Specifically, the method of claim 1 as now amended recites (i) detecting when an incoming message is received over the established connection from a sending node; (ii) determining a timeout corresponding to the time at which an acknowledgement message is

expected over the connection from the receiving node by the sending node; and (iii) sending a suppression message over the connection to the sending node if the acknowledgement message has not been sent to the sending node before the timeout expires. Support for these amendments can be found at least in Fig. 7 and in the specification as originally filed on page 10, line 24 through page 11, line 26. Withdrawal of this rejection is respectfully requested.

Applicants also note the term "remote node" has been removed throughout the claims as originally filed. Instead, for the purposes of clarity only, the claims are now directed to a method of monitoring and controlling message delivery between a "sending node" and a "receiving node." Support for these amendments can be found at least in the specification as originally filed on page 4, lines 3-9. No reduction in the scope of the claims is intended by these amendments.

The Examiner rejected claim 8 under 35 U.S.C. § 112, second paragraph, as being indefinite. Specifically, the Examiner rejected claim 8 stating that the limitation "if we determine that the wireless link was lost" is unclear. Claim 8 is now amended to now recite "sending the suppression message immediately if the wireless link was lost." Withdrawal of this rejection is respectfully requested.

Claim Rejections – 35 U.S.C. § 101

The Examiner rejected claims 34 and 35 under 35 U.S.C. § 101 because the claimed invention is directed to non-statutory subject matter. Claims 34 and 35 have been amended to properly recite patentable subject matter as suggested by the Examiner. Applicants respectfully request withdrawal of this rejection.

Claim Rejections – 35 U.S.C. § 102

The Examiner rejected claims 1-36 under 35 U.S.C. § 102(b) as being anticipated by a 1997 printed publication entitled "M-TCP: TCP for Mobile Cellular Networks," by Brown et al. With entry of the foregoing amendments, Applicants respectfully traverse this rejection.

As previously discussed in the specification on page 7, lines 8-15 as originally filed, the M-TCP system of Brown employs a split connection between a wireless subscriber and a wired network server by terminating the wired TCP connection and instantiates a separate connection over the wireless link. Furthermore, in the M-TCP system, the sending and receiving nodes

communicate using different communication protocols. For example, Fig. 3 of Brown illustrates that the M-TCP system includes a Mobile Host (MH) that communicates with a sender on a standard wired network through a Supervisory Host (SH). Specifically, a first TCP connection is established between the sender and the SH and then a second M-TCP connection is instantiated between the SH and the MH. (See Brown, Fig. 3, sections 4, 4.1 and 4.2).

In contrast, the present invention is directed to a system and method of monitoring and controlling message delivery over a single point to point connection including a wireless link between a sending node and receiving node. Rather than split the connection, the present invention examines and processes incoming messages as they are received over the connection. Because the present invention does not split the connection, particular advantages include avoiding the need for setting up and tearing down connections. (See specification as originally filed on page 4, lines 10-17).

Another advantage is that by employing the method of the invention in a wireless gateway at either end of a wireless link, both the sending node and the receiving node communicate over the single point-to-point connection using a common communication protocol, such as standard TCP/IP. In other words, the present invention alleviates the need to modify the protocol stack at both nodes of the connection. (See Fig. 3 and specification as originally filed on page 4, lines 10-17 and page 7, lines 8-27).

Claims 1, 17, 34-36 have been amended to recite these features. Specifically, these amended claims recites structure or steps for (i) establishing a single point to point connection including a wireless link between a sending node and a receiving node, the sending node and the receiving node both communicating over the connection using a common communication protocol; (ii) detecting when an incoming message that is destined for the receiving node is received over the connection from the sending node by examining the incoming message; (iii) determining a timeout corresponding to the time at which an acknowledgement message is expected from the receiving node in response to the incoming message by the sending node; (iv) forwarding the message over the connection to the receiving node and (v) sending a suppression message over the connection to the sending node if the acknowledgement message has not been sent to the sending node before the timeout expires, the suppression message suspending messages from being sent by the sending node to the receiving node.

For example, in respect to Figures 1 and 2 a point to point connection is maintained between two nodes 12 and 30 via the wireless link. Accordingly, since bidirectional communication is provided, the base station processor 16 and the subscriber access unit 14 each provide a wireless gateway 230 supporting the wireless link 26. Each wireless gateway 230 includes a timer manager 232, a link detector 234, a segment generator 236, and a packet buffer 238. The timer manager 232 computes the roundtrip time corresponding to the time at which an ACK message is expected. When an incoming message is received from a wired link 40, a timer is set just prior to the time at which the corresponding sender will timeout for failure to receive the ACK. The incoming message is then forwarded over the wireless link 26. If the timer expires before the corresponding act is received over the wireless link 26, the segment generator 236 generates a suppression message, and sends it to the sender over the wired link 40. The suppression message tells the sender not to send any more messages until the receiver sends a resume message. When the corresponding act is received from the wireless network, it is stored in the packet buffer 238. The segment generator 236 forwards the ACK message to the sender over the wired link 40. The sender then interprets this as a resume message. (See Figs. 1, 2 and specification, page 6, line 17 through page 7 line 7 as originally filed).

For at least these reasons, claims 1, 17, 34-36 as now amended are novel and non-obvious in view of the prior art of record, and thus are patentable.

Furthermore, at least by virtue of their dependency upon independent claims 1 and 17, dependent claims 3-16 and 19-33 are also patentable.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

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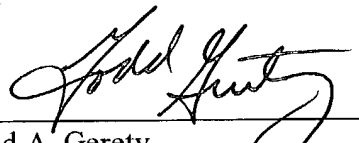
By 

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